Supplement to Inyo County's comments on groundwater impacts

This supplemental section discusses in detailed scope Inyo County's groundwater studies program, and specific oversights found in the draft Repository Supplemental Impact Statement (draft SEIS). It is incorporated by reference in the main text of the County's comment letter. The County's general conclusions regarding the adequacy of the draft SEIS are:

1. The draft SEIS does not fully reference or utilize DOE sponsored Inyo County hydrogeology research on the Lower Carbonate Aquifer (LCA).

2. The draft SEIS does not fully or accurately characterize the LCA.

3. The draft SEIS does not adequately discuss the upward gradient in the LCA as a barrier to radionuclide transport, or possible impacts on repository performance with a possible loss in the upward gradient due to regional groundwater usage.

1. The draft SEIS does not fully reference or utilize DOE sponsored Inyo County hydrogeology research on the LCA

The 2002 FEIS and SEIS references and utilizes data from the Nye County Early Warning Drilling Program. Inyo County geologic and hydrologic studies are referenced in a single paragraph in Section 3.1.4.2.1 (Regional Groundwater), with minor notations in various texts. A brief summary of Inyo County's research is provided with references.

With funding from the U.S. Department of Energy (DOE), Inyo County has been conducting geological and hydrological studies since 1997. Specifically, the County is concerned with potential transport, by ground water, of radionuclides into Inyo County, including Death Valley, and the evaluation of a connection between the LCA and the biosphere. Key research conducted includes:

- Geological mapping.
- Construction of a LCA monitoring well on eastside of Southern Funeral Mountain Range.
- Geophysical surveys of portions of the Amargosa Valley and Death Valley areas.
- Geochemical sampling and testing of springs and wells in Death Valley National Park.
- Numerical groundwater modeling of the LCA in the Amargosa Valley and Southern Funeral Mountain Range.

All of these materials are, and have been, available to the DOE. The DOE should analyze and incorporate all of Inyo County's findings regarding groundwater impacts in its Final

SEIS. All of the materials supporting Inyo County's findings regarding groundwater impacts can be found below.

References

Bredehoeft, et. al., 2005, The Lower Carbonate Aquifer as a Barrier to Radionuclide Transport, Waste Management Conference 05, WM 5482.

Bredehoeft, et. al., 2007, Radionuclide Transport from Yucca Mountain and Inter-basin Fow in Death Valley, Waste Management Conference 07, WM 7120.

Bredehoeft, et. al., 2007, Radionuclide Transport from Yucca Mountain and Inter-basin Flow in Death Valley: Testimony to U.S. Nuclear Waste Technical Review Board, May 15.

Inyo County, September 2005, Death Valley Lower Carbonate Aquifer Monitoring Program-Wells Down Gradient of the Proposed Yucca Mountain Nuclear Waste Repository: U.S. Department of Energy Cooperative Agreement DE-FC08-02RW12162 Final Project Report.

Inyo County, August 2007, Death Valley Lower Carbonate Aquifer Monitoring Program-Wells Down Gradient of the Proposed Yucca Mountain Nuclear Waste Repository: U.S. Department of Energy Cooperative Agreement DE-FC28-06RW12368 Year One Project Report.

King, et. al., 2003, Inyo County, California, Regional Ground Water Monitoring Program, Testimony to U.S. Nuclear Waste Technical Review Board, October.

King, et. al., 1999, Death Valley Springs Geochemical Investigation, Yucca Mountain Nuclear Repository, Inyo County Oversight-1998, www.hydrodynamics-group.com, March.

2. The draft SEIS does not fully or accurately characterize the LCA

The draft SEIS provides only a limited characterization of the LCA. The draft SEIS characterization of the LCA should be expanded because of the importance of the LCA as a barrier to radionuclide transport at Yucca Mountain. A discussion of the LCA should also accurately represent the current data on the LCA.

Bredehoeft, et. al., Waste Management 2007 Conference paper and Bredehoeft's testimony in May 2007 to the Nuclear Waste Technical Review Board provides a characterization of the aerial distribution and hydraulic properties of the LCA at and down gradient of Yucca Mountain. The paper also describes Inyo's understanding of the LCA and which has been provided to the DOE's for its consideration. The following is a concise summary of the properties and characteristics of the LCA.

DEATH VALLEY REGIONAL GROUNDWATER MODEL

Concern about the potential transport of contaminants from both the Nevada Test Site and from Yucca Mountain led to groundwater flow models being developed for both sites. Initially two separate models were developed—one for the Test Site by IT/GeoTrans and a second for Yucca Mountain by the United States Geological Survey (USGS). Initially this was a duplicative effort. It was decided to merge the two efforts into a single model under the leadership of the USGS.

A groundwater flow model of the area poses unique problems. The area is broken up into mountain ranges and intervening valleys. In addition the area was at the continental margin during much of its geologic history; the facies of many of the stratigraphic units change in the area of the model. While there are outcrops of the rocks in the mountain ranges, there are few drill holes in the valleys that penetrate the LCA. Creating the model was a challenging problem.

The final USGS model design is unusual. The model consists of 16 layers that are created based loosely upon elevation—they are more or less horizontal slices of rock. Superimposed on the layers is the usual horizontal finite difference grid—cells are 1500 meters by 1500 meters in the east-west and north south-direction. Using this grid system the rocks that underlie the region can be assigned into the grid cells within the model (5).

This modeling system has both strengths and weaknesses. Its strength is that it readily accommodates the rapid horizontal changes in lithology that occur within the region—all the differing rocks are readily accommodated. The scheme has the disadvantage that it is hard to follow a given aquifer through the model. For example, one has to search for all the cells in each layer that contain Paleozoic carbonate. One then has to aggregate the information from the layers to obtain a picture of the total carbonate rock at any location. If several layers at any given location contain Paleozoic carbonate the head representing the aquifer at that location has to be interpreted from the head in each of the model layers

Geology in the Model

There are few drill holes in the area of the Death Valley flow system model that reach the Paleozoic carbonate aquifer beneath the valleys. Outcrops of the various stratigraphic units, including Paleozoic carbonate rocks occur in the mountain ranges. However, in order to fully populate the model it is necessary to interpret the geology, especially the geology beneath the valleys. Geologists constructed a series of cross-sections through the area of the model that depicted their interpretation of the geology.

Geologic mapping in the mountain ranges where the rocks are exposed is a more or less straightforward procedure. However, interpreting the geology beneath the valleys is a much more subjective endeavor, even when it is guided by regional geophysics. There is the further problem that the data must be interpolated from the cross-sections to the model grid; errors in input can occur in this procedure.

In summary, the USGS Death Valley Regional Flow System Model has the advantage that the laterally discontinuous nature of rocks in the region are accommodated. The model has the disadvantage that it is difficult to extract information of interest. It is Inyo's intent to extract from the USGS as much information as possible that pertains to the LCA.

The Palezoic Carbonate Aquifer

Of particular concern to Inyo County is the Paleozoic carbonate aquifer, or LCA. Inyo County has extracted from the USGS Death Valley Regional Flow Model the data pertaining to the Paleozoic carbonate aquifer. Figure 1 is a distribution map for the carbonate taken from the USGS Regional model area (see next page).

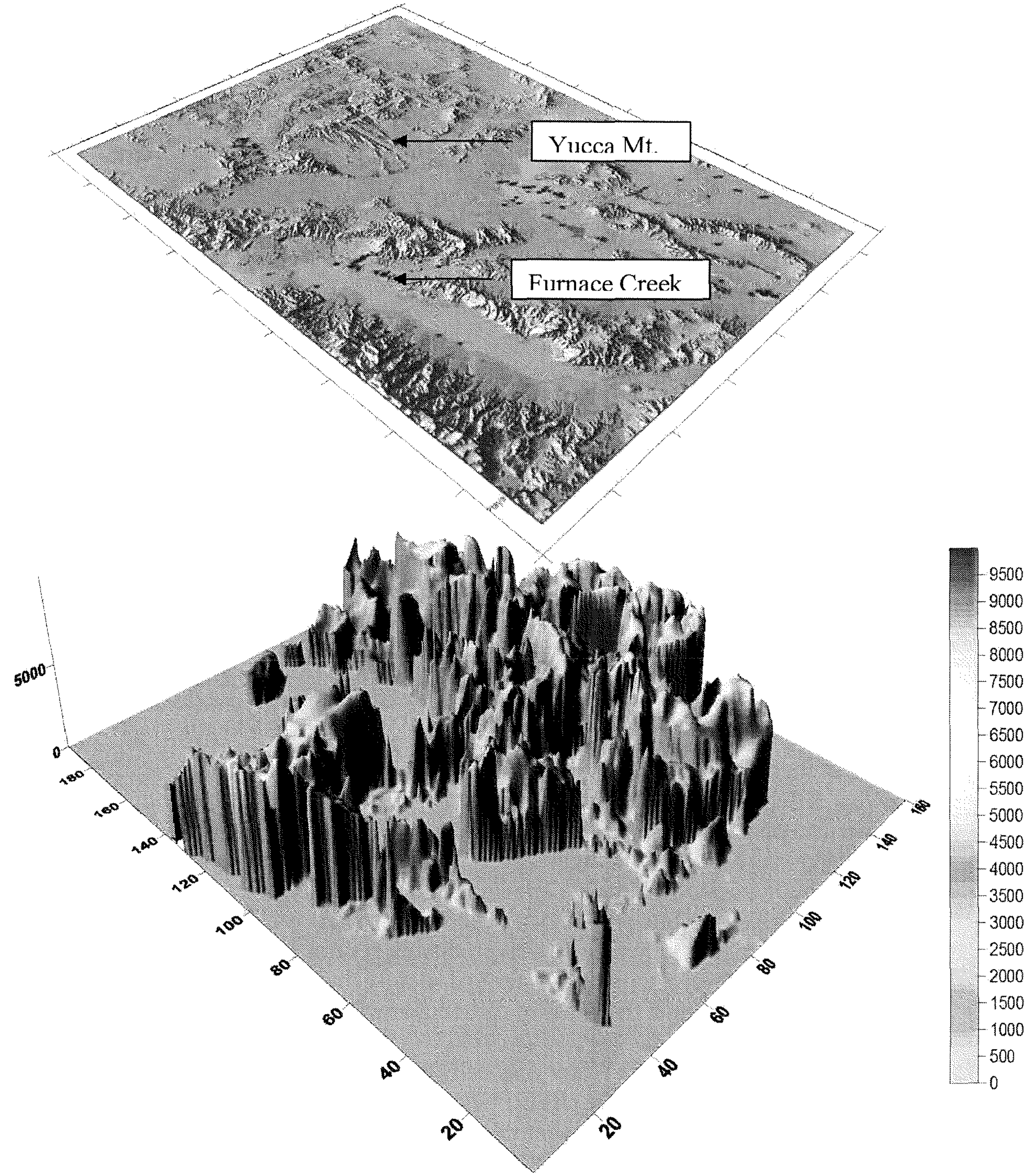

Figure 1. Distribution of Carbonate Rocks in the Death Valley Regional Flow System Model.

As Figure 1 illustrates, the carbonate rocks are discontinuous across the region. In places they are very thick, reaching more than 5000 meters in thickness. A large mass of carbonate rock underlies Yucca Mountain and the Amargosa Valley that extends through the Southern Funeral Mountains.

The potentiometric surface for the area indicates an area of low gradients over the Amargosa Valley that is bound by an area of high gradients through the Southern Funeral Mountain Range to the southwest to a spring discharge area in Death Valley. the area of low gradients discharge occurs at Ash Meadows, and to a lesser amount in Pahrump Valley, Shoshone and Tecopa.

Amargosa Valley Sub-Region

Inyo County's focus is on Yucca Mountain, the Amargosa Valley, and the Southern Funeral Mountains. It is through this area that the Paleozoic carbonate aquifer provides a potential pathway for contaminants to be transported from Yucca Mountain to the biosphere.

We extracted from the USGS regional model the thickness of the Paleozoic carbonate rock in the sub region. Figure 2 is an isolith map for the Paleozoic carbonate rock within the sub-region. Not all of the sub-region contains carbonate. Beneath the Amargosa Valley the Paleozoic carbonate rocks are greater than 5000 meters thick. In this area, even extensional basin and range faults with large vertical throws would juxtapose carbonate rocks against carbonate rocks across the faults. With such large thickness of carbonate rock one can understand why the aquifer integrates the subsurface flow at depth.

Each researcher working on the hydrogeology of the Paleozoic carbonate aquifer has a somewhat different conceptual image of what forms the interconnected pore space of the Paleozoic carbonate aquifer. The brittle carbonate rocks are broken up by the tectonics of the basin and range. Joints and faults in the rock have been enlarged by subsequent dissolution of the rock. Caverns are known to occur—Devils Hole is a good example. The question arises: can one drill anywhere in the carbonate rock terrain and obtain a reasonable productive water well—a well producing several hundred gallons a minute or more? Experienced Nevada ground-water hydrologists believe this is possible, provided that one drills a "sufficient" thickness of carbonate rock.

Recently the Southern Nevada Water Authority (SNWA) proposed to pump groundwater from valleys to the south and east of Ely, Nevada and pipe it to Las Vegas. Estimates vary for their proposed withdrawal; but they talk in terms of 190 million cubic meters annually (150,000 acre-feet). One of their early requests to the Nevada State Engineer is for a water right to pump 110 million cubic meters (90,000 acre-feet) annually from Spring Valley. SNWA's contractor, Durbin & Associates, assembled hydraulic conductivity values for the entire Paleozoic carbonate region as input for a model of Spring Valley. Figure 3 illustrates a cumulative distribution of transmissivity taken from the SNWA data.

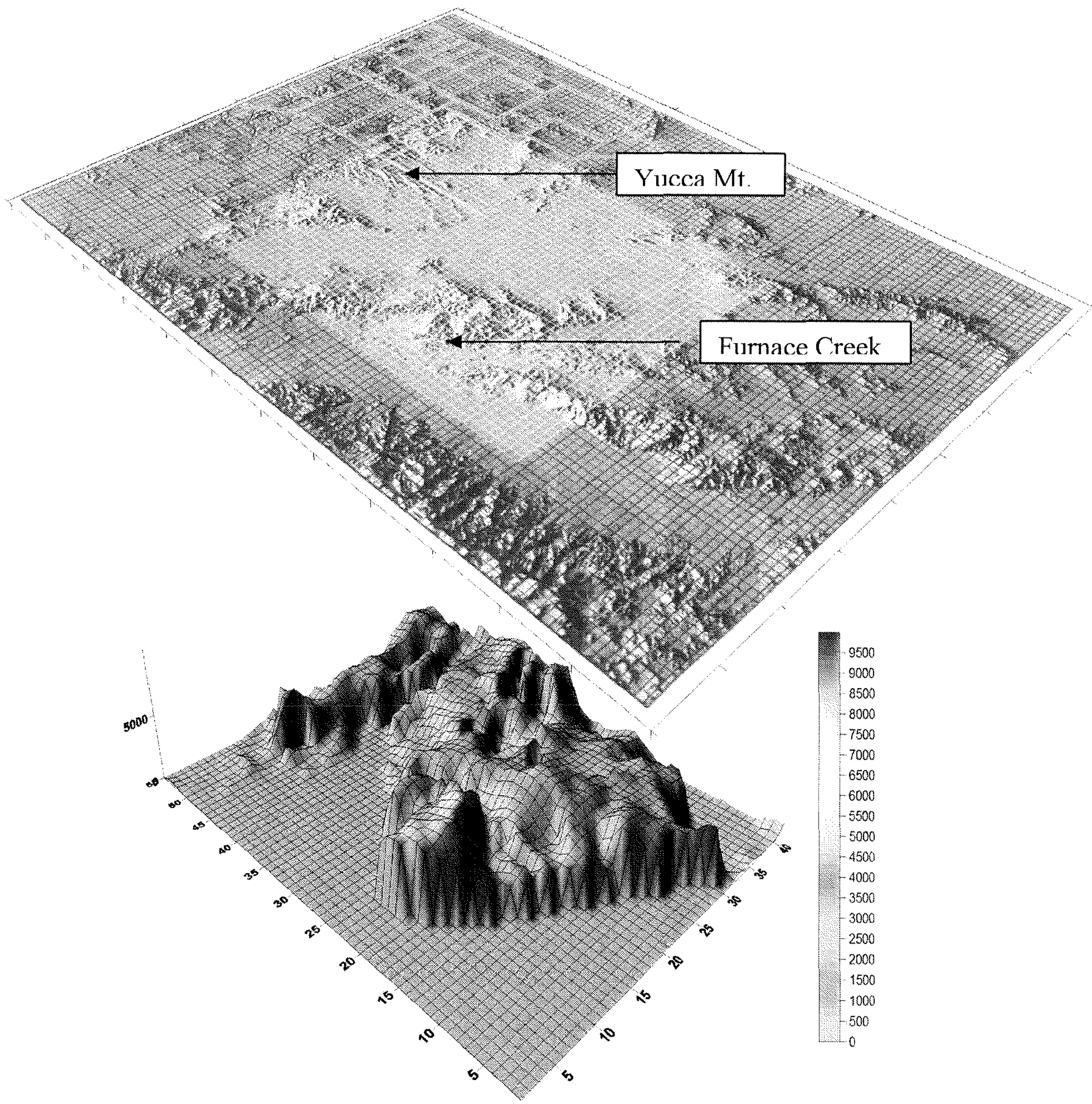

Figure 2. Thickness of the Paleozoic Carbonate Rocks in the Sub-Region.

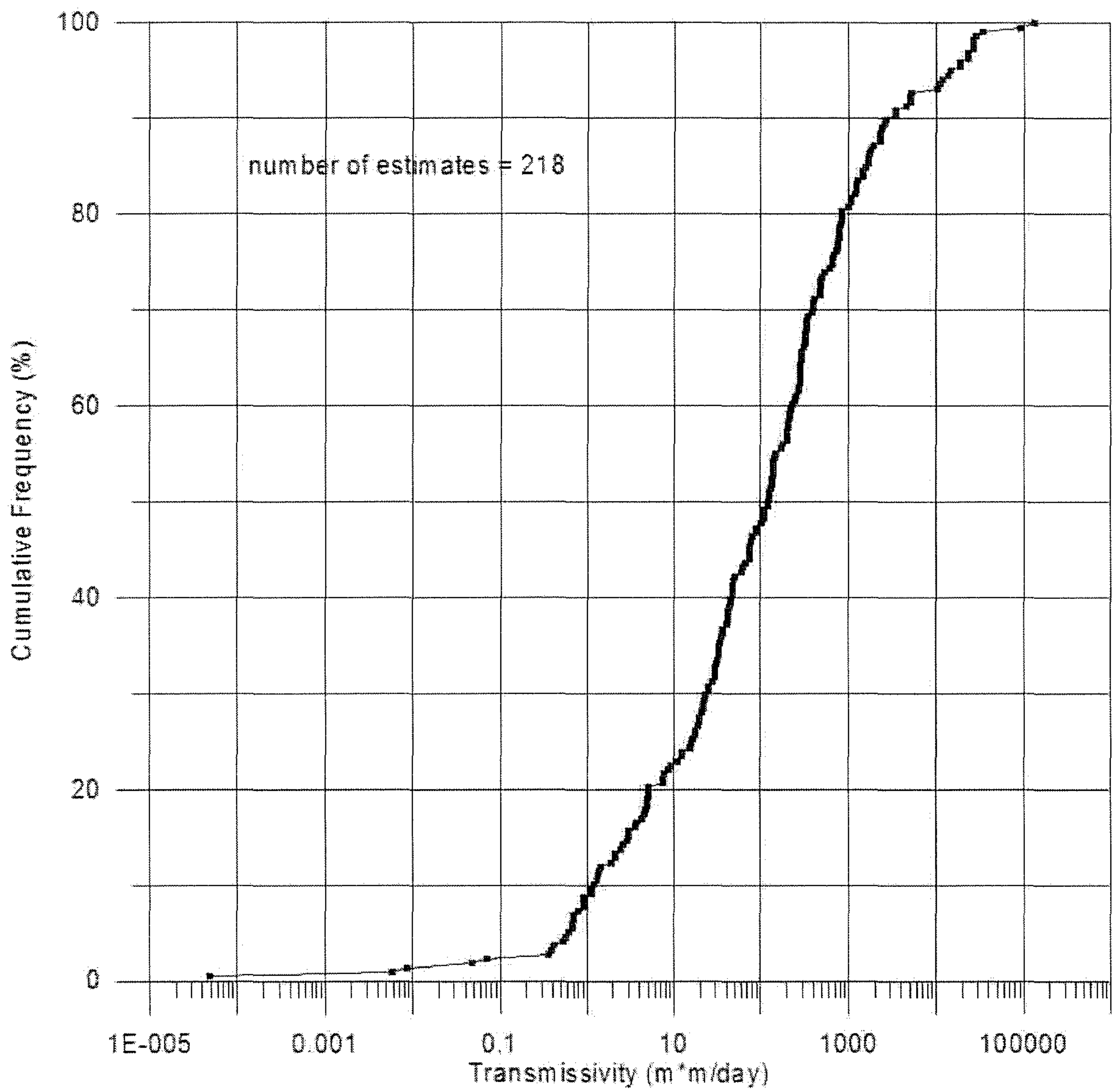

Figure 3. Cumulative Distribution of Transmissivity from SNWA Data (SNWA, 2006).

The data suggest that there is approximately an 85% chance of obtaining a well that yields 0.4 cubic meters per minute with 30 meters of drawdown (100 gpm with 100 feet of drawdown). It also indicates that there is approximately a 10% chance that a well with 30 meters of drawdown will yield approximately 8 cubic meters per minute (2000 gallons per minute with 100 feet of drawdown).

One can calculate a hydraulic conductivity from the Transmissivity data. The usual assumption is that the screened interval, or the open-hole section of the portion of the well tested should be divided into the transmissivity to obtain a local estimate of the hydraulic conductivity. If one compares the cumulative ratio of the cumulative distributions you see that the hydraulic conductivity generally represents approximately 30 meters of tested well section. This suggests that there is about an 85% chance that if one drills a sufficiently thick section of Paleozoic carbonate rock one will find a 30 meter, or smaller zone that is sufficiently permeable to yield a good well (defined as more than 100 gallons per minute with 100 feet of drawdown).

In other words, the simple conceptual model of the hydraulic conductivity in the aquifer shows the aquifer contains at least a permeable zone, maybe 10 meters, or several tens of meters thick, more or less everywhere where the Carbonate rocks are more than several hundred meters thick. The permeability is enhanced where it is associated with recent faulting within the carbonate units. Barriers to flow seem to occur where the carbonate is juxtaposed against less permeable rock. Caves are known in the carbonate rock; for example, Devils Hole is a known cave.

There is some suggestion in the carbonate data that the hydraulic conductivity decreases with depth; however, the data is very scattered. Some workers explain that this scatter is due to burial; on the other hand, the temperature rises with depth making the water less viscous, increasing the hydraulic conductivity. Researchers seem to assume a depth of burial beneath which the hydraulic conductivity does not decrease further. This seems questionable, given the noisy nature of the data, that correcting the hydraulic conductivity for depth adds much to the precision of the analysis.

The conceptual model may not be all that important when one's concern is only the movement of water. However, when you begin to transport chemical constituents the nature of the conduit for flow becomes all-important—more on the permeability/porosity conceptual model below.

A Simple Flow Model

One simple way to investigate the system is to assume that the principal pathway for flow is mostly through the Paleozoic carbonate aquifer. With this thought in mind one can construct a model for flow through only the carbonate rock; this is a simplistic, first-order approximation for the system; but it provides insight. The USGS in their RASA study used a two-layer idealized model—this model is even simpler.

In the Ash Meadows/Amargosa area the largest amount of recharge comes from the Spring Mountains. The big discharge areas are in Ash Meadows, Pahrump Valley, in the area of Shoshone and Tecopa, and in Death Valley. Approximately 75% of the recharge comes from the Spring Mountains.

Inyo County created a one-layer model of the Paleozoic carbonate aquifer. As suggested above, this is a kind of zero-order model that provides insight into how contaminants might move through the carbonate aquifer. In this model the aquifer is decoupled from the overlying Tertiary deposits. Where the Paleozoic carbonate aquifer has been penetrated in the area, a good low-permeability confining layer overlies the aquifer. We know that this isolates the aquifer, not totally, but certainly to a great degree. So the simple model is only useful in that it provides an estimate of how contaminants might move. Figure 4 is a computed steady-state potentiometric surface generated from the one layer model. Flow is continuous in the aquifer from the area of Yucca Mountain to the discharge area in Death Valley.

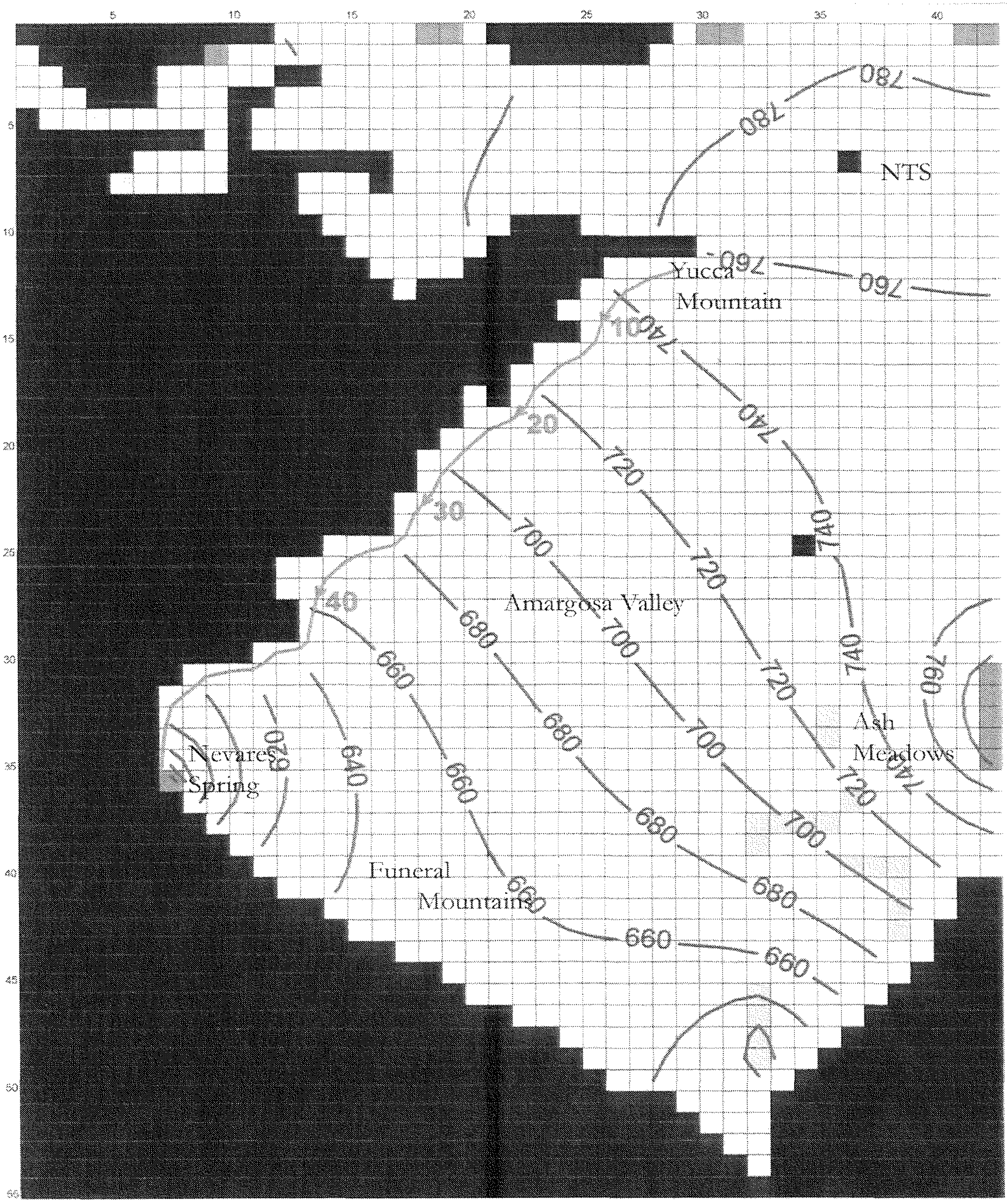

Figure 4. Map of Steady State Hydraulic Head from the one Layer Carbonate Aquifer Model.

The yellow areas are spring discharge areas. The red line is a particle track for a particle introduced in the vicinity of Yucca Mountain that exits in Death Valley—the red numbers are estimates in years of the time of travel for the particle.

Potential for Contaminant Travel Through the Carbonate Aquifer

One common way to estimate the time of travel of a chemical constituent is to assume that the constituent moves with the velocity of the water. In groundwater flow, Darcy's Law defines the groundwater velocity as:

$v = K/\varepsilon \, (\partial h/\partial l)$

Where v is the groundwater velocity, K is the hydraulic conductivity, ε is the porosity, and $(\partial h/\partial l)$ is the gradient in hydraulic head. The question becomes what is the appropriate porosity to apply to the calculation? This again raises the issue of how one conceives the connected pore space in the aquifer. There are several investigations that shed some information on this issue.

Winograd and Pearson investigated the isotopic content of major springs in the Ash meadows complex. They focused particularly on carbon 14 that varied greatly between individual springs. They concluded that the carbon 14 content of the springs was best explained by what they termed "mega scale channeling" within the aquifer.

One hole in the vicinity of Yucca Mountain, UE 25p1, penetrated approximately 500 m of the Paleozoic carbonate aquifer. Galloway and Rojstaczer (10) studied earth tide signals in the carbonate aquifer. They concluded that the aquifer was well confined, and that the storage coefficient derived from their analysis indicated porosity less than 1%. Craig and Robison (11) estimated from a pumping test that the transmissivity of the carbonate aquifer penetrated by the hole was 59 m^2/day this is approximately mid-range in the transmissivity distribution (see Figure 3).

The evidence suggests that the porosity one assigns to the carbonate aquifer to estimate the velocity of groundwater flow should be less than 1%. This is consistent with a fractured zone in the thick carbonate sediments that is highly permeable.

The particle path line, shown on Figure 4, is calculated using a permeable zone 100 meters thick, with a porosity of 0.1%. With this calculation it takes less than 50 years for the particle to travel though the aquifer from vicinity of Yucca Mountain to Death Valley. If the porosity were 1% the travel time would be 500 years.

What Protects the Carbonate Aquifer at Yucca Mountain

Borehole UE 25p1 had a hydraulic head in the Paleozoic carbonate aquifer that was 15 m higher than the hydraulic head in the overlying Tertiary volcanic rocks. This higher head has the potential to move groundwater upward from the carbonate into the overlying volcanic sequence of rocks. As long as the head relationship remains as presently observed the carbonate is protected from contamination moving downward from the repository to the carbonate aquifer.

Summary and Conclusions

The Paleozoic carbonate aquifer, or LCA in the Death Valley flow system has been the site of intensive investigation since the 1950s. Conventional wisdom, that has become doctrine, has the carbonate aquifer integrating the ground water flow in the area. The investigations have intensified as the Federal Government has embarked on building a nuclear repository at Yucca Mountain. One of the more ambitious of the projects has been the construction of the USGS Death Valley Regional Ground Water Flow Model.

Any model of contaminant transport through the carbonate aquifer depends heavily upon how one pictures the connected pore space in the carbonate rocks. Inyo's conceptual model is of a thick carbonate sequence that contains a zone ten to several tens of meters thick where the rocks are fractured and provide a permeable pathway for flow. The information suggests that everywhere there is a reasonable thickness of carbonate rock one can obtain a reasonably good water well, provided he/she drills a sufficient thickness of the rock. One can enhance his/her chances of getting a really good well by going to places where recent tectonics movements in the region have further disturbed the carbonate rocks.

Finally with this model in mind transport through the carbonate aquifer from a location near the site of the repository at Yucca Mountain to the biosphere in Death Valley will be relatively rapid. Our calculation with a permeable zone 100 m thick and porosity of 0.1% indicates a transit time of less than 50 years; if the porosity is of the order of 1% the time is of the order of 500 years.

3. The draft SEIS does not adequately discuss the upward gradient in the LCA as a barrier to radionuclide transport or possible impacts on repository performance with a possible loss in the upward gradient due to regional groundwater pumping

The importance of the upward gradient in the LCA as a barrier to radionuclide transport at Yucca Mountain, and the potential impact of down gradient pumping on repository Total System Performance Assessment (TSPA), is not discussed in the draft SEIS. It is also evident from discussions with DOE-Office of Civilian Radioactive Waste Management (OCRWM) that the hydraulic relationship between the LCA and the Tertiary aquifers is misunderstood. The upward gradient in the LCA represents an important natural barrier to radionuclide transport from Yucca Mountain. It is believed that downward migration of radionuclides through the Tertiary Saturated Zone aquifers will be stopped by the higher hydraulic head or pressure from the LCA. Thus, understanding the hydraulic relationship between the Tertiary and LCA is critical TSPA analysis.

The upward gradient in the LCA has been established from water level measurement in LCA monitoring wells UE25p1, Nye County well 2DB, National Park Service Ash Meadow wells GF-2A and 2B, and Inyo County well BLM #1. This data indicated the LCA has an upward gradient at Yucca Mountain and over most of the Amargosa Valley. Geochemical data from the Nye County Early Warning Drilling Program Wells show a carbonate signature that indicates a hydraulic connection between the Tertiary and LCA.

Numerical groundwater modeling has been performed for the region at and down gradient of the Yucca Mountain repository by the United States Geological Survey (Belcher, 2004), by the State of Nevada Engineer's Office (Water Rights Ruling 5750), and by The Hydrodynamics Group, LLC (WM 2007). These numerical groundwater models demonstrate the hydraulic connection between the Tertiary and LCA systems. The models show that the potentiometric surface in the Tertiary aquifer system is supported by the upward gradient in the LCA.

Hydraulic head is one of the more ephemeral of hydrologic conditions. Head is subject to change by development of groundwater for water supply in the Amargosa Valley south of the repository site. The population of southern Nevada is growing rapidly. Local groundwater is looked to for a large portion of the water supply. Both the valley fill deposits and the Paleozoic Carbonate Aquifer are targets for development. Groundwater pumping, lowering the hydraulic head, could eliminate the upward hydraulic head gradient that serves as the barrier to contaminate movement into the LCA at Yucca Mountain.

Current pumping rates from water wells in the Amargosa Valley and Yucca Mountain areas were modeled into the future for a 1,000-year period. Both the Nevada State Engineer's and Hydrodynamics models show an approximate 10-meter drop in the saturated zone water level below Yucca Mountain after 1,000 years of pumping at current rates (Bredehoeft, et. al., 2007).

A reduction in water level in the Tertiary aquifer will cause a loss of head, or hydraulic gradient, in the LCA. As water is withdrawn from the Tertiary aquifer at a rate that exceeds recharge, the hydraulic system will approach a new equilibrium. The upward gradient in the LCA will go to support the lowered head in the Tertiary auqifer. The net result, over time, will be a lowering and possible loss of the fragile upward gradient in the LCA.

Therefore, ground water development could destroy the upward head gradient in the LCA that currently serves as a barrier to downward contaminant movement at Yucca Mountain. Should contaminants reach the LCA, they will be transported quickly to the springs in Death Valley. The TSPA and Pre-Closure Safety Analysis should take into account potential groundwater impacts to Inyo County.

Conclusion

The ultimate conclusion from Inyo's groundwater studies is that the LCA is a good pathway for contamination to the biosphere. Every effort should be made to keep contaminants out of the LCA that may include protection of the upward hydraulic gradient in the Paleozoic carbonate aquifer. The draft SEIS needs to address the importance of the upward gradient in the LCA as a barrier to radionuclide transport from Yucca Mountain, and the potential impacts and mitigation of those impacts on total system performance.

Specific comments/recommendations on the draft SEIS

Inyo County respectfully provides the following comments on specific sections of the SEIS.

Section 3.1.3 Geology, pg 3-16
DOE provides a detailed discussion of Nye Counties geological studies related to Yucca Mountain. Inyo County recommends that DOE add a third paragraph describing the County's geological studies related to Yucca Mountain.

Section 3.1.3.1.1 Site Stratigraphy and Lithology, pg 3-17
DOE should identify the source for the Paleozoic Era carbonate rocks at the Ue25P1 well. It should also include the stratigraphy and lithology from Nye County well 2DB, NPS wells GF-2A and 2B, and Inyo well BLM #1.

Section 3.1.3.1.2 Selection of Repository Host Rock, pg 3-18
The DOE should add a fifth reason for selection of the Yucca Mountain repository site. Specifically, 5) the upward gradient of the LCA as a barrier to radionuclide transport.

Figure 3-5, pg 3-20
The white geological unit below Yucca Mountain should be identified on the figure and in the legend.

Section 3.1.4.2.1 Regional Groundwater, pg 3-27
The first paragraph of this section does not reference Inyo County geological studies and well drilling data. The Final EIS should specifically reference Inyo's work in describing the Carbonate aquifers in the Death Valley region.

Section 3.1.4.2.1 Regional Groundwater, pg 3-29
Inyo County disagrees with the statements in the first paragraph at the top of page 3-29: "Although carbonate aquifers are regionally extensive, they are not necessarily extensively interconnected and often occur in compartments (DIRS Nye County Nuclear Waste Repository Project Office-NWRPO 2001, p.F53) that might or might not have a hydraulic connection to the carbonate rock in an adjacent compartment." First, the Nye County research does not accurately represent the regional data collected on the LCA by Inyo County and the NPS. Second, the USGS Death Valley Regional Groundwater model, publications by Winograd, USGS, and Inyo County's models of the LCA aquifer system indicate that the LCA is highly connected and provides a bases for inter-basin flow between the Amargosa Valley and Death Valley through the Southern Funeral Mountain range.

The second paragraph on page 3-29 should include a discussion on the observed regional upward gradient in the LCA with its contribution to the regional groundwater table.

Section 3.1.4.2.1 Regional Groundwater, Basins, pg 3-31
Paragraph three does not reference Inyo County in relation to groundwater conditions and movement in the Death Valley region. Belcher, 2004 and Bredehoeft, et. al., 2005 and 2007 groundwater models characterize groundwater flow through the Amargosa Valley basin. An explanation of this research should be included.

Section 3.1.4.2.1 Regional Groundwater, Basins, pg 3-32
Paragraph one provides a reasonable explanation of Inyo County's studies with emphasizes on geochemical data. The County recommends the DOE include the results of Inyo's geological mapping, geophysical surveys, LCA monitoring wells, and numerical groundwater modeling for completeness.

The County disagrees with the last sentence of the first paragraph that states "However, water that moves south from the volcanic aquifers (such as Yucca Mountain area) is not a primary source for those discharges. Chemical modeling and groundwater models suggest some portion of waters from the Yucca Mountain area contribute to the flows to Death Valley.'

A paragraph should be added after the first paragraph to discuss the LCA flow system.

Section 3.1.4.2.1 Regional Groundwater, Uses, pg 3-32 & 33 and Table 3-4, pg 3-34
The discussion of water uses in the Amargosa Valley does not discuss the potential impacts of groundwater withdrawals from the Amargosa Farms area on the regional water table that includes Yucca Mountain. Some discussion on the findings of the Nevada States Engineer's Water Rights Ruling 5750 should be included.

DOE should ensure the perennial yields stated for the Amargosa Desert reflect the Nevada States Engineer's Water Rights Ruling 5750.

Section 3.1.4.2.2 Groundwater at Yucca Mountain, Saturated Zone, pg 3-39
Inyo County agrees with the majority of the discussion presented in the second paragraph. However, the last sentence should be changed to state:

This is significant in the assessment of the postclosure performance of the proposed repository (see Chapter 5 of this draft SEIS) because it constrains the pathway by which *radionulcides* could move after repository closure ***providing the upward gradient in the LCA is preserved over time.***

Section 3.1.4.2.2 Groundwater at Yucca Mountain, Saturated Zone, Water Sources and Movement, pg 3-42
The first paragraph of Water Sources and Movement need to be qualified. The groundwater pumping referred to appears to be limited to only pumping at the Yucca Mountain repository site, which has relatively low and stable volumes of water for some time. However, the critical issue is the impact of the large scale regional pumping on the stability of water levels at Yucca Mountain. As discussed earlier, projections of current

pumping in the Amargosa Valley for 1,000 years could results in a 3-meter drop in the water table below Yucca Mountain. This situation should be addressed the Final SEIS.

Section 3.1.4.2.2 Groundwater at Yucca Mountain, Saturated Zone, Inflow to Volcanic Aquifers at Yucca Mountain, pg 3-45

Inyo County disagrees with the last sentence of this section that states "The amount of inflow from the carbonate aquifer, if it exists, is unknown." The thermal modeling of the upward gradient in Ue25p1 and the regional groundwater modeling of the LCA in the Yucca Mountain region shows that inflow from the LCA into the Tertiary aquifers exists. This section should be corrected to reflect the current data from the LCA studies.

SEIS Section 8 Cumulative Impacts

Section 8 of the SEIS makes no mention of the potential impacts from a potential loss of the upward gradient in the LCA on the TSPA of the Yucca Mountain. Limiting the discussion of what impacts the repository will have on the environment versus impacts the environment may have on repository performance is not responsive to the goals of the NEPA process. The DOE should include a discussion on the significance of the upward gradient of the LCA on repository performance.

SEIS Section Best Management Practices

Section 9 of the draft SEIS provides a detailed discussion on the issues that may impact Nye County concerning the proposed Yucca Mountain repository. Yucca Mountain has the potential for radionuclide transport into Inyo County through the major springs in Death Valley National Park via the LCA or at Franklin Lake Playa via the volcanic Tertiary aquifers. The DOE should provide the same level of effort to discuss potential impacts to Inyo County due to the potential of radionuclide contamination of groundwater.